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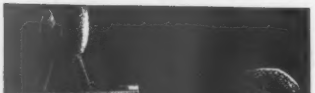

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FOUNDRY TRADE JOURNAL
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Vol. 70 Thursday, June 10, 1943 No. 1399

Wartime Scrap

Due perhaps to our prior association with the special steel trade, we were perhaps better placed than most foundrymen to recognise and assess the exceptional amongst the deliveries of scrap received for remelting. During the last war we picked out quite useful amounts of high-speed, magnet and manganese steel. Knowing their worth they were put to good use. The foregoing supplies a sufficiently sound foundation to make a plea that so long as the war lasts, some knowledgeable member of the foundry staff should be detailed to make routine inspections of all scrap consignments. Because the foundry manager never or rarely sees any non-ferrous scrap on the cupola stage, that is no guarantee that none was present on arrival. We remember when we had charge of a North-East Coast works, being impressed by the solicitude shown by a couple of labourers for any loss the company might incur through the demurrage of wagons. The haste with which they left any job to unload scrap aroused our suspicions, so, after a suitable interval, we visited the scene of action and "accidentally" bumped into the jackets of the labourers conveniently depending from a nearby wall. After the usual banter, it was revealed that these labourers possessed an elementary knowledge of metallurgy, and the sole reason for purloining brass scrap was to prevent its contaminating the steel! An equitable arrangement was thereupon established whereby the brass scrap should be sold for the benefit of the mess-room funds. Another angle of scrap examination, or rather lack of it, is drawn from a third personal experience. The practice at an East Anglian foundry, which we were controlling, was to charge up after the last cast of the day, ready for putting on current early next morning. The men engaged in doing this charged in a steel tube, not shell scrap, which contained explosive matter. As a result, the two men spent some weeks in hospital suffering from severe burns. We have heard of similar experiences during this war, and all melters should be advised when receiving tubular scrap to ascertain that it contains nothing in the bore. Then there is the sorting of the scrap resulting from runners and risers, and waster castings. There is much need for this in those foundries making alloyed iron and a system should be devised so that all the members of the staff are familiar with the markings of the grade, their collection, segregation and storage. Knowing what can happen in foundries, it is quite easy to imagine a stock of nickel cast-iron scrap to be set on one side, only to find that someone unfamiliar with the object sought, has used it up for quite unessential jobs.

We always admired the way the old-timers could grade the compositional nature of grey-iron scrap from the nature of the job they had fulfilled during their useful life, and compound the various sorts to give them the type of metal sought. With the passage of time and metallurgical progress, this has been more difficult, as resort during the last decade has been made to alloying. Unfortunately, but few foundries operate a spectroscopic system of analysis, for this appears to us as being the rational method for ascertaining whether any consignment of scrap contains a serious percentage of alloyed material. However, the large scrap merchants are in their own interests rapidly taking advantage of all modern means for the segregation of higher priced material. Apart from the enrichment of scrap by alloys, there is also the fact that large quantities of scrap of Regency vintage are entering the foundry, and where uniformity exists valuable data as its worth, positive or negative, can be had by resort to the statistical method of control.

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PATTERNMAKING WRINKLES—XI

By "CHIP"

Taper or draft is necessary on most patterns to facilitate removal from the mould. In some instances the amount of taper is specified on the drawing, but in the majority of cases this is left to the discretion of the patternmaker. There are a number of points to be considered before deciding on the amount of taper. The claims of the machine shop have to be remembered as well as those of the foundry. While the latter requires the maximum taper possible, the former desires castings practically square. An example of compromise is shown in Fig. 1, in which the foot A of the bracket is desired by the machine shop as square as possible with the back B. To accommodate the machinist and also make the pattern easily mouldable only a slight taper is imparted to face C of foot A, but an excess of taper is allowed on face D. Similarly the face E of the nut seat E is only given a slight draft, while the boss F and rib G are generously tapered.

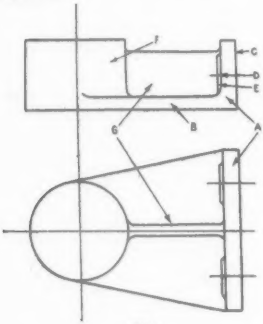

FIG. 1.

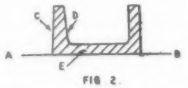

FIG. 2.

FIG. 3.

The danger of increasing the weight of a casting and also of increasing a local thickness unduly which may cause casting strains is often the result of indiscriminate addition of taper. A simple example illustrating the principle is shown in Fig. 2, in which is shown a part section of a steel bedframe. As only a limited quantity were required and a metal pattern was out of the question, a block pattern and corebox was used to withstand the hard ramming necessary for steel. Other detail, not illustrated, decides that the joint of the mould is along line A.B. This requires a taper as C. The patternmaker may so construct the corebox to require a taper as D. This immediately increases the weight and causes a difference of section at the junction with the member E. A better way is to construct so as to get the taper of the core to compensate that of the mould, as Fig. 3.

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Are your compressed lines being operated by squanderbugs?

CORRESPONDENCE

BLIND RISERS

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The remarks of Mr. Tom Smith on page 316 of the December 10, 1942, issue of THE FOUNDRY TRADE JOURNAL, concerning the article by Mr. Rominski and myself on the use of blind risers are noted. We sincerely hope that this does not reflect the attitude of British foundrymen in general.

We do not necessarily recommend that the keel block be made as shown—this was used merely as an example of an interesting type of shrinkage and to illustrate a principle. We very definitely challenge Mr. Smith's statement that feeding castings from the bottom "will in itself give bad results." We know from much experience with the method that bottom feeding has many advantages (all given in the Paper) and that sound castings will result. Concerning his suggested method for making the castings shown in Figs. 1 and 2, we agree that some foundrymen consider his the least-complicated moulding job, but ours will yield much sounder castings. We have tried both methods many times.

We urge British foundrymen to give atmospheric pressure in blind heads an adequate test before condemning a method which has been put to such excellent use in America. As one American author so aptly put it, ". . . it is just one of those things that require a complete mental somersault before it can be satisfactorily understood or used," and even though it seems to defy age-old foundry custom, it is none the less workable.—Yours, etc.,

HOWARD F. TAYLOR.

Naval Research Laboratory,
Anacostia Station,
Washington, D.C.

[We can assure Mr. Taylor that, generally speaking, Mr. Tom Smith's views do not reflect the consensus of opinion in Britain, but rather of a still important minority.—EDITOR.]

DATA ON ALUMINIUM ALLOYS

The Federated Metals Division of American Smelting & Refining Company has published a comprehensive booklet, entitled "Aluminium Alloys," covering the standard specifications for all grades of aluminium alloys (casting grades only). The work consists of three indices and 13 specification tables. The index section gives complete references on Federal, Army, Navy, Army-Navy Air Corps, S.A.E., A.S.T.M., and Alcoa standards. Specifications cover the following alloys:—8 per cent. copper (No. 12); copper-silicon; 4 per cent. copper; 10 per cent. copper-magnesium; copper-nickel-magnesium (Y Alloy); 5 per cent. silicon; 13 per cent. silicon; silicon-magnesium; copper-silicon-magnesium; high silicon (low expansion); 4 per cent. magnesium; 10 per cent. magnesium and die-casting special. Copies of the booklet may be had from the General Aluminium Department of Federated Metals Division, American Smelting & Refining Company, Detroit, Mich.

PEARLITIC MALLEABLE CAST IRONS*

Mechanism of graphitisation, annealing cycles, heat-treatment and effect of gases and alloys on graphitisation and physical properties

By A. E. PEACE

Pearlitic malleable cast irons have been commercially made for the past 15 years, and during the latter part of that time the varieties and methods of production have been increased and improved. These materials have been developed from blackheart malleable cast iron. Reference to blackheart malleable in this Paper must be understood to apply to a material with total carbon content about 2.40 per cent. produced with a completely ferrite matrix and giving physical properties as follows:—Tensile strength, 24 tons per sq. in.; yield strength, 16 tons per sq. in.; elongation, 15 to 20 per cent.; and Brinell hardness, 110 to 120.

It can readily be appreciated that for certain applications blackheart malleable such as described is rather soft and not as strong as desired. The pearlitic malleables are so called because the ferrite matrix of normal blackheart is replaced by pearlite or some other transition structure of the austenite. This may be to a variable extent and material may be produced with an all-pearlitic matrix or only partially so. Where any of the ferrite matrix of blackheart malleable is intentionally replaced by pearlite or other austenite transition structures, such as martensite or sorbite, the material properly falls into the class of pearlitic malleables. As expected from this brief metallographical description, pearlitic malleable possesses greater strength and hardness, but rather lower ductility, than normal blackheart.

For a ready understanding of the various processes of production, it is necessary to refresh one's mind upon the mechanism of the production of blackheart malleable. In view of the extensive literature[1 2 3 4] on this latter subject, it is unnecessary to deal with all aspects, and it will only be treated here as is necessary to produce a satisfactory picture to illustrate the production of pearlitic malleable.

Graphitisation

The manufacture of blackheart malleable commences with a white cast iron, free from graphite, containing all its carbon in the combined form. This material is then submitted to an annealing treatment whereby the carbide is completely broken down, resulting finally in a structure of nodules of free carbon in a ferrite matrix.

Considering this process of graphitisation, the steps may be followed by means of equilibrium diagrams. The white iron consists of pearlite and cementite, as shown in Fig. 1. The equilibrium diagrams of Fig. 2 cover both the metastable (iron carbide) and stable (graphite) systems. Some modifications are necessary in the light of more recent research work, but as the present purpose is to create a picture of the graphitising process, greater precision is not essential. Now, as the white iron is heated above the critical point, the pearlite is transformed to austenite with a carbon content of about 0.9 per cent. As the temperature is increased, the austenite absorbs carbon from the cementite, maintaining its saturation at any temperature in accordance with the line ES in the metastable system, so that at 900 deg. C. the austenite will contain about 1¼ per cent. carbon. Reference is made to this temperature as it conforms with commercial practice and is convenient for demonstration purposes. Now, whilst this increase in temperature is being accomplished, the saturated austenite precipitates some of its carbon in the free state as graphite. This graphite is in the shape of nodules and is referred to in malleable practice as temper carbon.

There are thus two reactions taking place; on the one hand, free carbon is being precipitated from the austenite, denuding it of its carbon, and, on the other hand, the austenite is making good this loss and attempting to maintain its saturation by dissolving carbon from the cementite. As the temperature of 900 deg. C. is maintained, these reactions proceed, more free carbon being deposited at the expense of cementite, until equilibrium is reached and all the carbon in the cementite has been dissolved, when the structure consists of nodules of free carbon and saturated austenite. The austenite now contains some 0.95 per cent. carbon and is saturated with respect to graphite. It should be understood that at the commencement of the graphitising process the austenite is saturated under metastable conditions (line ES). As graphitisation proceeds, there is obviously a carbon gradient through the austenite, the solid solution adjacent to a cementite particle being saturated, according to ES and that adjacent to a graphite nodule being saturated (with a less amount) according to E′S′.

This gradient is a necessary feature of carbon migration. When all the cementite has been destroyed the austenite will come to a uniform saturation under stable conditions. Continued holding will produce no further change in the amount of free carbon deposited nor in the carbon content of the austenite. Now if the temperature is slowly lowered the austenite will be saturated with less carbon, according to the line E′S′, and more free carbon will be precipitated until the critical point on cooling is reached. At this stage the austenite contains about 0.5 per cent. carbon and transforms to pearlite, which will graphitise completely if the temperature be held just below the critical,

* A Paper presented before the Lincoln Section and the Birmingham Branch of the Institute of British Foundrymen.

Pearlitic Malleable Cast Irons

or as is more usual in practice if a very slow rate of cooling, say 5 deg. C. per hr., be maintained down to some 20 or 30 deg. below the critical. There is then a complete ferrite structure, with temper carbon nodules as illustrated in Fig. 3.

Mechanism of Crystallisation

It is customary to refer to the graphitisation taking place whilst obtaining equilibrium at the maximum temperature as first stage graphitisation and the graphitisation on cooling to below the critical as second stage graphitisation. Whilst there is a very considerable literature on the subject of graphitisation, the matter is exceedingly difficult of investigation, and

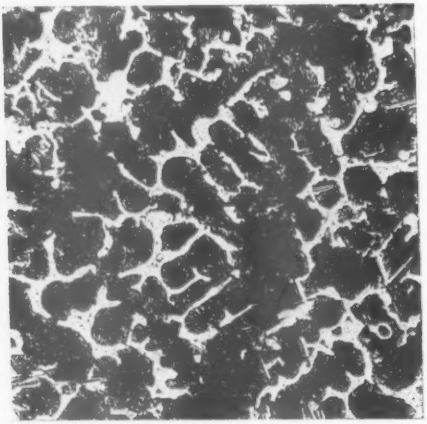


FIG. 1.—WHITE CAST IRON; ETCHED WITH NITRIC ACID. (× 100.)

the actual mechanism is but poorly understood. It is clear that a number of steps are involved. There has to be a dissociation of the iron and carbon of the carbide, a solution of this carbon in the austenite, a crystallisation of graphite, and a migration of carbon to the centres of crystallisation.

It is not known how a nucleus of crystallisation is initiated. Schwartz[5] has demonstrated that the graphite centres form at the interface of the carbide particles and the austenite. A hot concentrated alkaline picrate etch was used upon fully graphitised material. This reagent differentially attacks the ferrite and shows up the original pattern of the austenite and free cementite due, Schwartz suggests, to the etch distinguishing between varying silicon concentrations. Morrogh[8] has shown and discussed graphite nucleisation by sulphide particles, and this is perfectly compatible with nucleisation at the carbide surface since the presence of sulphides at grain boundaries is quite likely. It is also probable that internal stresses assist in the birth of nuclei. Wells[7] has shown that graphite can be formed both from the austenite solid solution and directly from free cementite. Experience suggests that in malleable cast irons the graphite centres preferentially form from the austenite.

The number of centres of crystallisation and therefore the number of temper carbon nodules which are

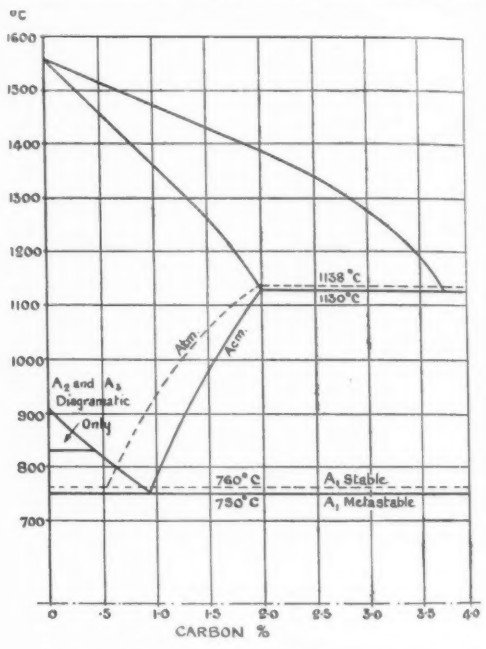


FIG. 2.—BENEDICK'S EQUILIBRIUM DIAGRAM; MODIFIED BY SCHWARTZ FOR AN IRON-CARBON ALLOY CONTAINING APPROX. 1 PER CENT. SI.

formed has a considerable effect upon the rate of graphitisation. With many nodules graphitisation proceeds in more places at one time, and migratory distances are reduced so that completion is obtained more quickly. Heating slowly to the annealing temperature favours the formation of numerous nodules,[6] as also does high initial soaking temperature.[9] It is also known that white iron heated to temperatures of 900 to 1,000 deg. C., and rapidly cooled, produces more numerous nodules upon annealing, which it has been suggested may be due to a spheroidising of some of the cementite particles when heating to the annealing temperature.[10]

Returning now to a consideration of the two stages of the graphitisation process and assuming one has carried out the first stage by holding sufficiently long at a temperature above the critical, the second stage is now only completed by slow cooling through or holding at a temperature just below the critical. Completion of this second stage can clearly be prevented by giving insufficient time for it to take place. In practice this is accomplished by cooling quickly through or reducing the holding time around the critical.

Annealing Cycles

The diagrams shown in Fig. 4 illustrate a variety of annealing cycles. The abscissæ are time and the ordinates temperature. In each diagram the broken line indicates the critical temperature. Diagram A is

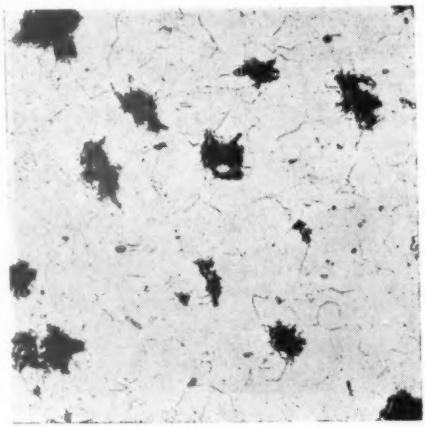


FIG. 3.—BLACKHEART MALLEABLE CAST IRON: ETCHED WITH NITRIC ACID. (× 100.)

a typical annealing cycle for producing blackheart malleable. It will be seen that there is a holding at the maximum temperature to the point denoted by S, when all the cementite has disappeared and equilibrium is established. The cooling is then very slow through the critical, permitting completion of second stage graphitisation, and the resulting product has a ferrite matrix. Diagram B shows another commercial method of producing the same result. Equilibrium is established at point S, and the cooling is rapid to below the critical, where the metal is held for a sufficient time to complete second stage graphitisation and yield a ferrite matrix. This holding may also take place in steps as recommended by Ziegler.[11] In diagram C is illustrated a rapid cooling from the point S by quenching. Whilst equilibrium was established at S and therefore there was no free cementite in the metal at that point, the extremely rapid cooling would prevent second stage graphitisation, and the quenching could be even so drastic as to retain the matrix in a martensitic condition. In diagram E, a slower rate of cooling is indicated, although in this case much faster than in A, and whilst some second stage graphitisation would take place, the matrix structure would be largely composed of finely laminated pearlite.

A somewhat similar result would be obtained by the treatment shown in F, where rapid cooling has been followed by a short hold at just below the critical which would give time for the austenite to transform to a fine pearlite structure. It will be realised that, in the treatment shown in diagram C, the high-carbon martensitic structure produced by quenching would have but very poor shock resistance and a further heat-treatment can be carried out

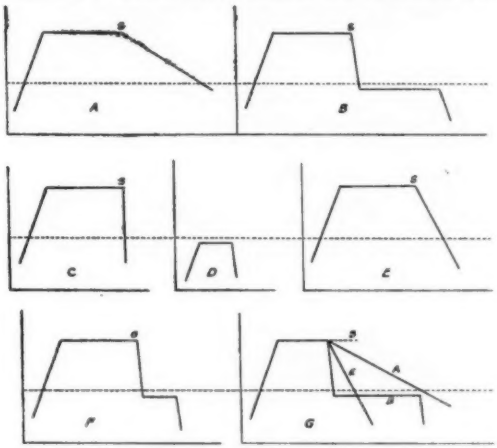


FIG. 4.—DIAGRAMMATIC TIME AND TEMPERATURE CYCLES.

as illustrated in D, which consists of a reheat and holding period just below the critical, resulting in a sorbite or pearlite structure. It will be appreciated that after establishing equilibrium at the higher temperatures, the rates of cooling and the holding periods below the critical can be varied within considerable limits, and this variation not only affects the transition stage of austenite which is reached, either martensite, troostite, sorbite or pearlite, but also can permit a certain amount of second-stage graphitisation to take place with the production of ferrite, depending upon the rates of cooling and times of holding. One can thus obtain an infinite variety of matrix structures and vary the physical properties produced.

In diagram G it will be seen that the holding time at the maximum temperature has not been continued until equilibrium has been reached at the point S,

and in this case, when cooled from the maximum temperature, the metal will contain a proportion of eutectic cementite which has not been destroyed. The subsequent cooling will substantially affect only the condition of the matrix in which the undestroyed carbides are distributed, and this matrix can be again produced in any desired structure by using variations in cooling rates. For example, A and B, indicated in diagram G, are the types of cooling which will produce a ferrite matrix. Some idea of the range of structures obtainable with the heat-treatments indicated may be gathered from a few illustrations.

Fig. 5 shows a "bullseye" structure in which the

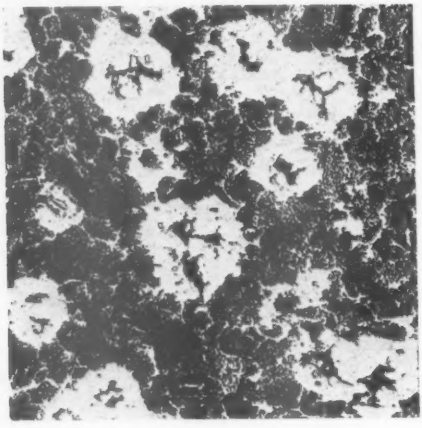


FIG. 5.—"BULLSEYE" STRUCTURE; ETCHED WITH PICRIC ACID. (× 100.)

matrix is pearlite with a considerable amount of ferrite forming lakes around the temper carbon nodules. This is typical of a rate of cooling (diagram E of Fig. 4) intermediate between the very slow rate which is used to complete second-stage graphitisation and the air quench which practically prevents any second-stage graphite being formed. In Fig. 6, at high magnification, is shown the structure produced by cooling from 930 deg. C., at a rate of approximately 7 deg. C. per minute. The matrix is exceedingly fine pearlite, and it will be noticed that traces of ferrite exist, showing that some slight graphitisation has taken place even with this rapid rate of cooling. Fig. 7 illustrates the arrest of first-stage graphitisation, as indicated in diagram G of Fig. 4. This specimen was annealed for 4 hrs. only at 900 deg. C., and oil-quenched. Appreciable quantities of eutectic cementite remain in a matrix of pseudo-martensite.

Austempering

It will have been noticed that among the heat-treatments described some have a similarity to the quench and temper used in hardening steels. During the last few years a new hardening treatment for steels has been developed, known as "austempering." Instead of quenching into water or oil, followed by reheating to draw or temper, the metal is quenched into a liquid bath (*e.g.*, molten lead), held at a definite suitable temperature. The hardness obtained is determined by this temperature, provided a minimum holding time is given in the bath. This treatment on steels produces improved toughness. Cowan[13] and also Walker[13] have published some results on pearlitic malleable produced by "austempering," but

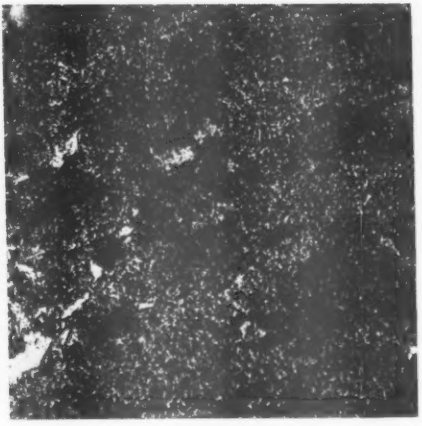


FIG. 6.—COOLED FROM 930 DEG. C., AT 7 DEG. PER MIN.; ETCHED WITH PICRIC ACID. (× 500.)

there are insufficient data to determine whether improved properties are obtainable. The method is, however, of great interest and warrants further investigation.

Carbon Re-solution Process

It has long been known that when blackheart malleable is reheated above the critical temperature temper carbon will go back into solution, the amount redissolved depending upon the temperature and time. Advantage has been taken of this to produce pearlitic malleable, which differs from the types previously described by reason that the carbon goes into solution and diffuses first of all along the grain boundaries, so that after a short time above the critical a network structure is obtained in a ferrite matrix.

It is, of course, possible to hold the metal above

the critical for a sufficiently long time to obtain diffusion through the grains, in which case structures can be obtained similar to those indicated under arrested anneal processes. However, in this reheat method it is usually desired to go no further than the production of the network structure which is first obtained in the martensitic condition by quenching and subsequently tempered to produce sorbite. Fig. 8 shows such a structure. The matrix is ferrite with sorbite forming a network around the grain boundaries. A concentration of sorbite will be observed surrounding the temper carbon nodules, and evidence will be seen of diffusion of carbon through the grains. The re-solution of some of the free carbon by reheating above the critical is also used to produce surface hardening by means of flame and induction heating. By this process a martensitic structure is obtained in the surface, of hardness equivalent to case-hardened steel.

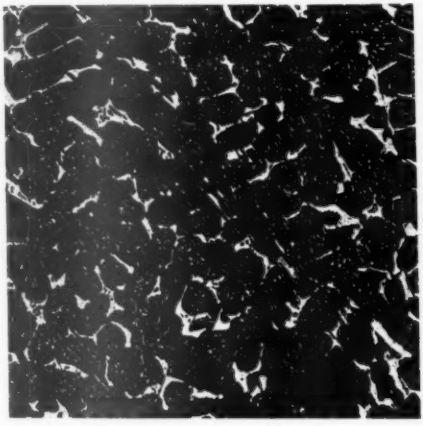


FIG. 7.—INCOMPLETE EQUILIBRIUM ABOVE A; ETCHED WITH NITRIC ACID. (× 100.)

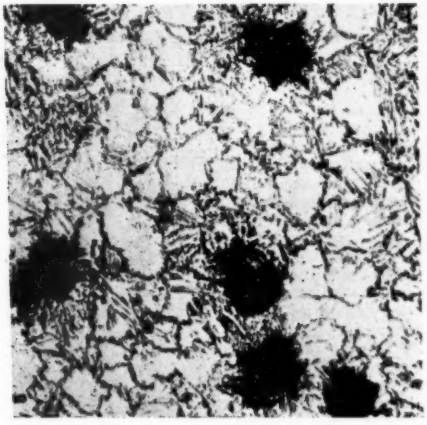


FIG. 8.—REHEATED ABOVE A; ETCHED WITH PICRIC ACID. (× 100.)

Heat-treatment Furnaces

In the processes already described it is obvious that precise control of heat-treatment is needed, particularly of cooling rates. When operating with batch-type ovens handling large charges, it is not usually possible to obtain cooling rates as fast as required. This has led to further development of small-size batch ovens and of larger capacity continuous furnaces. In these types of furnaces a controlled atmosphere is secured, so that the work can be processed without resorting to packing in boxes and without the lag inseparable from such a method. In some treatments the work is discharged from the furnace into a quenching bath, in others into an air quench which may be accelerated by air blast. A separate furnace is then used for the further heat-treatment below the critical.

It is appropriate here to deal with annealing atmospheres, and this warrants, first, a consideration of the effect of gases in the metal.

Effect of Gases in the Metal

Hydrogen.—Molten iron has a great solubility for hydrogen, but this is very materially lower in the solid. However, minute quantities are known to retard graphitisation.[14] It is therefore fortunate that hydrogen is expelled early during the annealing process and no ill-effects are noticeable. Interesting work[15] has recently been carried out which shows that treating the molten iron with hydrogen followed by a low-temperature heating of the white cast iron results in greatly increased nucleisation, and consequently more rapid graphitisation.

Oxygen.—Most manufacturers of blackheart malleable suspect oxygen as having decisive effects upon graphitisation, but there is little concrete evidence available. There is some information[16] that it may accelerate graphitisation by nucleisation.. There is also a possibility that oxide films may retard graphitisation. It is established that oxygen-contaminated cementite is stable under annealing conditions and will not dissociate into iron and carbon.

Nitrogen.—Nitrogen is usually regarded as inert and unlikely to affect graphitising reactions. However, it has recently been indicated[17] that nitrided white iron graphitises rapidly, due to nuclei increase, and also that nitrogen introduced into the melt causes a response to low-temperature preheating of the white iron in a similar manner to that previously indicated under hydrogen.

Pearlitic Malleable Cast Irons

Effect of Atmosphere on Graphitisation

Hydrogen.—Annealing in an atmosphere of hydrogen, or gases which will yield hydrogen by decomposition at annealing temperatures, retards graphitisation, possibly because this prevents the elimination of hydrogen from the metal. Wells[8] has shown that graphitisation in a hydrogen-hydrocarbon atmosphere is slower than in vacuo.

Oxygen.—Oxygen by decarburisation gives at once a $CO.CO_2$ mixture, and such mixtures are said to accelerate annealing, although White and Schneidewind[18] consider that, even though varied from oxidising to reducing, they have no direct effect. However, the indirect effect is pronounced and annealing times are prolonged when an oxidising atmosphere exists. This causes surface decarburisation, which reduces the quantity of graphite nodules formed in the surface metal, so that both first-stage and second-stage graphitisation are restrained. This is of considerable importance in pearlitic malleables, since the decarburisation effect may cause the retention of eutectic cementite in the surface and can also result in complete removal of carbon in the skin and thus prevent surface hardening if this treatment is desired.

Cowan[19] has discussed this matter very fully, and suggested that the atmosphere should be rich and strongly carburising in the early stages of anneal and leaner in the later stages. In this country much work has been done on the subject during the war, and when publication can be made it will be found that great advances have been achieved. In Fig. 9 carbon gradient curves are given for three different casts of malleable annealed under identical conditions. Total carbon content is related to section measured from the surface. These curves are typical for blackheart type malleable exposed during annealing to "incidental" oxidising atmospheres. The extremely sharp fall in carbon content is characteristic, and its position is moved to left or right as the atmosphere is less or more oxidising. So far consideration has only been given to pearlitic malleables produced by means of variation of heat-treatment.

(To be continued.)

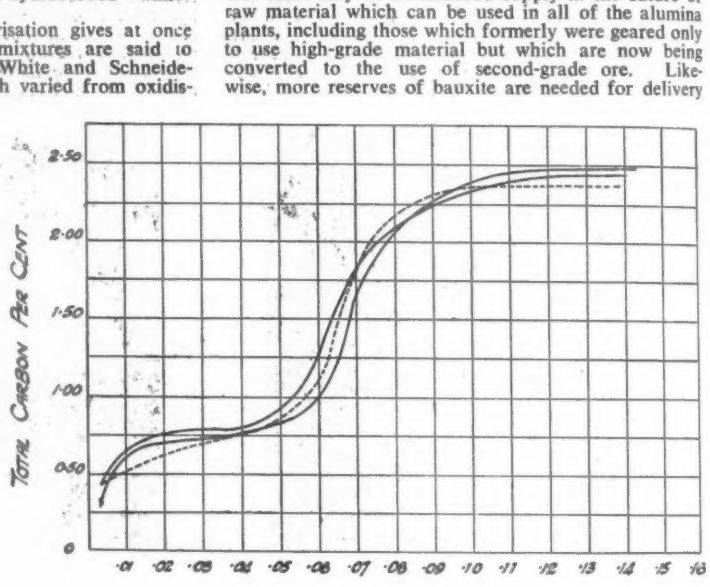


FIG. 9.—CARBON GRADIENT CURVES.

SECOND-GRADE BAUXITE PLANS IN U.S.A.

Under joint plans of the Bureau of Mines of the U.S. Department of the Interior and the W.P.B., the Bureau is undertaking the first steps for greatly expanding the search for additional reserves of domestic bauxite, alunite and aluminous clays. Increased reserves of second-grade bauxite must be developed so that there may be a continued supply in the future of raw material which can be used in all of the alumina plants, including those which formerly were geared only to use high-grade material but which are now being converted to the use of second-grade ore. Likewise, more reserves of bauxite are needed for delivery to Canada and for use as abrasives in American war plants.

Bureau officials explain that their programme indicates that a mill capable of converting 15 to 30 per cent. silica bauxite into less than 7 per cent. silica concentrate at the rate of 1,800 tons of concentrate daily can be built in three months. If the construction of this mill were immediately authorised, it would supply plants now capable of using only the high-grade material, but which will at a later date be prepared to use directly bauxite containing up to 15 per cent. silica, at which time the mill product would be available for abrasives and chemicals. Another phase of the Bureau's programme proposes the construction of commercial plants to produce alumina from domestic clays and from alunite.

PERMEABILITY TESTING

A NOTE ON THE TESTING OF FOUNDRY MOULDING AND CORE SANDS

By R. C. TUCKER, M.A.

The normal cast iron or non-ferrous foundry does not encounter very open sands, but in steelfoundries the use of sands such as "Arnolds 52" (Report of Moulding Materials Sub-Committee, THE FOUNDRY TRADE JOURNAL, January 14 and 21, 1943) has led the above Committee to question the suitability of the normal B.C.I.R.A. type of air bell for such open sands, and on quite good theoretical grounds the Committee designed a modification (*loc. cit.*).

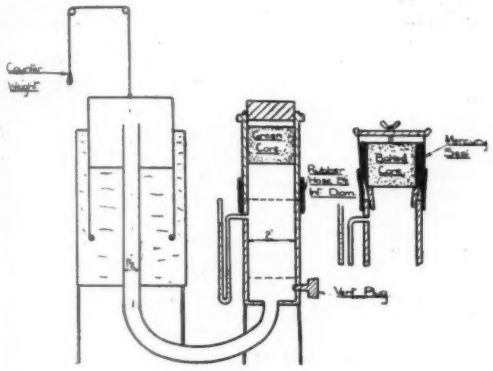


FIG. 1.—AUTHOR'S MODIFICATION OF APPARATUS TO INCLUDE BAKED CORES.

The author, at the time the Sub-Committee report was discussed in Sheffield, had encountered an oil-sand core problem, which required an even more open sea sand than the Southport in normal use. The permeability was of prime importance and the remarks of the Committee were studied carefully. A consignment of "Arnold 52" sand was ordered and a batch of core sand made up. The green core sand had a permeability on the B.C.I.R.A. tester of 9 secs. (A.F.A. No. 320), as against 15 secs. (A.F.A. No. 145) for Southport. It was found to be too coarse and the surface finish was unsatisfactory. By means of the B.C.I.R.A. tester a blend of "Arnolds 52" and "Southport" was selected to give a satisfactory permeability (200) and at the same time a full-scale trial gave satisfactory surface finish and adequate venting.

The B.C.I.R.A. tester had helped to solve the practical problem, but the presence of this more open core sand in the foundry cycle prompted the author to investigate the claims of the Committee. Little time is available for such work, but the results are presented here with a view to allaying the possible fears of other foundry laboratories that their permeability apparatus is not giving correct results.

The following are the stages of the experiments:—

Full "blank" time B.C.I.R.A. without core	..	4½ secs.
" " " without U or core base	..	3 "
" " " "vent" tap	..	3 "

The cause of the blank is, therefore, largely at the orifice at the inside end of the central tube of the air bell. It is suggested that the makers increase this orifice considerably. Even so, the apparatus has a blank and the pressure is not measured in the right place. The disadvantage of the apparatus, recommended by the Committee to reduce internal friction to a minimum, is that it will not allow the measurement of the permeability of a dried or baked core with a mercury seal, as the core holder would be upside down.

The apparatus shown in Fig. 1 was constructed out of materials available in the engineering shops to test the theory of the Moulding Materials Sub-Committee and to provide reliable control data of the highly permeable core sands. The "blank" of the apparatus is less than 0.5 sec., and the pressure is measured in a tube of 2-in. internal diameter just before the sand core.

TABLE I.—*Comparative Results Obtained from the Two Types of Apparatus.*

	B.C.I.R.A. pattern.	Modified apparatus (Fig. 1).
Open core sand	320	320
Southport core sand ..	145	144
Blended core sand ..	195	195
Facing sand	95	95
Light castings sand ..	30	30

The figures in Table I show that the same results are obtained with both forms of apparatus from A.F.A. 320 down to A.F.A. 30. This is not such a surprising result when it is considered that the speed of fall of the bell is governed by the size of the smallest "bottle-neck." In other words, very little error is introduced down to a permeability of 5 secs. when the "blank" is 4½ secs.

Thousands of tons of pearlitic malleable iron are being produced yearly in the United States to replace critical steels needed so badly for ships, planes, etc., at the same time saving many machine tools, and countless man-hours in machining time, reports J. H. SMITH, of the Saginaw Malleable Iron Division of General Motors Corporation, Saginaw, Mich., in "Steel." The importance of this material in many peacetime applications, together with the advantage offered in production of those parts led to its adoption in parts for many war items, such as small arms, ammunition, marine Diesel engines, transmissions, tank and truck parts and many other applications.

THE STUDY OF SHOP WASTERS AND THEIR CAUSES*

By V. C. WARREN.

When one endeavours to find out the causes of waste castings much can be learnt. As is generally known, there are many reasons. A moulder is often credited with waste which is no fault of his own. One particular reason for a great percentage of waste castings, especially in these times of black-out, is bad lighting; continually working in black sand under bad lighting conditions is a great strain on eyesight and the whole mental system. Waste occurs through sand being left in runners and moulds, badly finished moulds and the faulty positioning of cores.

When training young jobbing moulders, a careful study of their capabilities is called for to reduce waste. One has only to practice the art and craft of moulding in sand to appreciate the skill required. Until a young moulder has mastered the proportions of water required for damping down sand; the best method of pouring moulds; size of runner cups to use; area of downgates in proportion to ingates; the most suitable design and type of runners for the job in hand; the area of risers required to produce sound castings; the correct way to feed a job with rods; the most suitable casting temperature, then waste will be produced.

Practical Considerations

Careful consideration should be given to the ramming and venting of moulds, especially in green sand. Each layer of sand must be rammed hard enough to prevent a casting from swelling, yet not so hard as will cause scabbing. When venting a mould the first layer of sand rammed by "peg" should be carefully vented to within an inch of the pattern. Not only does a blunt vent wire penetrate the sand much more easily, but the damaging effect on wood patterns is reduced should the wire strike the pattern. When ramming deep jobs, each separate ram should be vented, increasing the size of wire as the job is rammed up; this enables a free liberation of gas, and therefore reduces the possibility of scabbing. Waste sometimes occurs through badly-designed patterns from a foundryman's point of view. Before ramming up a careful study of the job in question should be given. Often these jobs can be overcome by the placing of chills where castings have not to be machined.

Co-operation between pattern shop and foundry can also be the means of reducing waste. Factors germane to this are: (1) properly finished patterns; (2) their construction; (3) coreprints designed where possible to give clearance of core when closing moulds so as to avoid crushing; (4) coreprints of sufficient area to prevent cores from lifting when cast.

The proper placing of cores is often a problem to moulders. Sometimes cores are placed in their wrong position, which can be avoided, if, when a pattern-maker is constructing the pattern and core boxes he arranges a key on the coreprint of pattern and in the corebox to denote the correct position of cores. The advantage of sufficient taper where possible on jobbing patterns and in coreboxes is often overlooked by patternmakers. Not only does this assure good lifting in the top half of the mould and clean drawing of the pattern. If provisions are not made for good lifting and drawing of patterns, then the excessive rapping needed increases the seating area of cores. Should the corebox require the same treatment to release the core from the box, the core is made smaller and a cavity is, therefore, left between core seating and the core, when placed in the mould. The moulder, when sealing cores to prevent metal passing into vent, sometimes underestimates the amount of sand required to seal, and the result is that metal passes into the vent. If the sand required to seal the print is in excess, the mould crushes; this applies where it is not possible to bury a string-vent for the release of gas.

When constructing new patterns to be moulded by means of hand-rammed pattern plates, it is advisable, where possible, for the patternmaker to arrange for a suitable sealing over the coreprints. This will mould, leaving a small ridge of sand to safeguard against metal passing into the vent of the core. This is a simple matter where coreprints form half at the joint of mould. When moulds are cast with metal at a high temperature—especially does this apply to small castings—one thirty-second of an inch clearance around cores is sufficient to allow metal to pass into the vents.

Moulding Boxes

All moulding boxes are not everything to be desired from a moulder's point of view, especially does this apply to the fitting of pins. When hand-ramming moulds using plate patterns, the slightest movement in the fitting of boxes is liable to cause waste. Invariably moulding-box pins rust and wear just above their seating. This often causes great concern to a moulder. When ramming moulds, the top half of the box is located "sun road" or *vice versa* at a position where the pins are only slightly worn. After withdrawing the pattern plate and locating the top half of the mould for casting, the position is altered at the joint of the box where the pins are badly worn. Castings are sometimes rejected on account of blow holes caused by metal passing through a cavity between the core and the top half of the mould and into the vent of the core. This applies where cores form half at the joint of the mould.

Very much can be learnt by a thorough study of waster castings and their causes. In many cases it is necessary before ascribing a cause to break the casting. Not only can a moulder see and rectify his own particular failings, but also one learns to appreciate the co-operation needed from all departments connected with the foundry to produce good castings.

It is essential to give a moulder good working conditions in respect to lighting, shop heating and ventilation—especially during winter months, so that he can use his tools with comfort. Good patterns, moulding boxes and materials are needed to produce sound castings, and above all the opportunity to progress.

* A prize winning essay in a Competition organised by the London Branch of the Institute of Briti h Foundrymen for members joining since the war.

FORD'S NEW TRIPLEXING PLANT FOR STEEL CASTINGS

The largest triplexing installation in the United States for the production of steel for castings was recently put into operation by the Ford Motor Company. This installation, which has a capacity of 600 tons per 24 hrs. and provides metal for various types of armour and tank and aircraft castings, is described by W. A. Phair in "The Iron Age." A description of the general process was published in our issue of December 10 last.

One of the outstanding advantages of triplexing, and the main reason for adopting this process for its new steelfoundry, is that it provides a continuous supply of hot metal, a characteristic lacking in a converter, open-hearth or electric furnace installation.

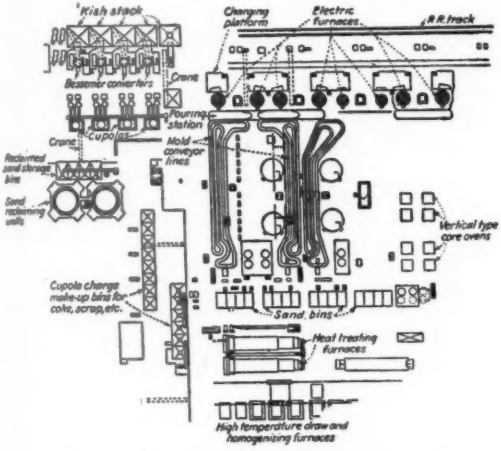


FIG. 1.—LAYOUT OF NEW TRIPLEXING UNIT.

Another advantage is that it permits charging a wide variety of types of scrap into the cupola, including in some cases cast iron, and yet producing a low-carbon steel casting. As the new Ford foundry is conveyorised, the importance of a reliable, continuous source of metal is obvious. The name triplexing is derived from the fact that the process provides progressive treatment of the metal in a cupola, a converter and an electric furnace (or possibly an open hearth), in the order mentioned. The new Ford foundry (Fig. 1) is equipped with four cupolas, four Tropenas converters and 12 electric furnaces. However, only a portion of these electric furnaces is used with the triplexing operations, the others being used in connection with certain other foundry operations. The arrangement of the cupolas and converters is shown in Fig. 2.

The four cupolas have a diameter of 96 in., lined to 72 in., giving a rated capacity of 20 tons per hr. The cupola blowers are of the centrifugal type, rated at 12,800 cub. ft. per min. at 2 lbs. discharge pressure. These blowers are of the pedestal type, with the impellers mounted on their own shaft, supported in two sleeve-type bearings. Pressure and volume are automatically controlled. The blast air for the cupolas is preheated in hot-blast stoves to about 315 deg. C. The cupolas all have front slag spouts and are acid lined. As protection against the dropping, the legs of the cupolas are bricked up to a height of about 10 ft.

Two cupolas are in constant use, with two acting as alternate or stand-by units. Slag is run into a trough at floor level filled with running water, through which a metal conveyor runs. The slag is granulated by the water and moved to a common disposal pit by the conveyor. A typical cupola charge consists of: 50 per cent. gates, risers, etc.; 25 per cent. low-phosphorus steel scrap; 25 per cent. low-phosphorus pig-iron.

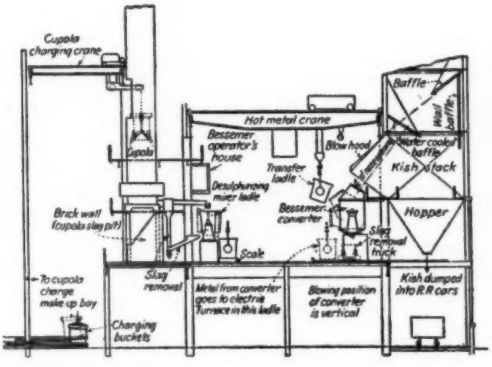


FIG. 2.—ARRANGEMENT OF CUPOLAS AND CONVERTERS.

Iron from the cupola, at between 1,425 and 1,455 deg. C. at the spout, is run into 8-ton teapot ladles, where it is desulphurised by use of about 30 lbs. of alkali per ton of metal. The iron from the cupola, after desulphurising, averages 3.00 to 3.25 C, about 1.50 Si, 0.03 to 0.035 S, and 0.05 per cent. P. The iron is taken from the teapot ladles and transferred to the converters in 6-ton transfer ladles. Very little loss of heat is experienced in the teapot ladle.

The converters are side-blown Whitings, acid-lined, of five- to six-ton capacity. It is believed that these converters are the largest side-blown units in successful operation in the United States. The converters embody several unique features, including centrifugal blowers which are rated at 10,000 cub. ft. per min., and deliver air at 5.5 lbs. pressure. The pressure and volume of the air delivered to the vessel is controlled

Ford's New Triplexing Plant

by a butterfly valve which is operated automatically.

The converters are also equipped with portable, auxiliary push-button controls mounted on a pendant. This auxiliary control simplifies tilting and levelling of the vessel as it permits an operator to hold the pendant control in his hand as he sights through the tuyeres for levelling. Actual blowing time in the converter is 17 to 18 min., with total elapsed time in handling a blow, including transfer, being of the order of a half-hour. After blowing, the metal averages 0.06 C, 0.03 to 0.05 Si, 0.05 to 0.10 Mn, and 0.03 per cent. S. Loss of metal in the converter operation is between 10 and 12 per cent. The temperature of the metal when it leaves the converter is 1,645 deg. C.

Samples are taken immediately after the blow and analyses for C and Mn are returned in 12 to 20 min. No additions are made in the converter, but Mn, Si and alloy additions, as required, are made in the electric furnace. Preceding delivery of the blown metal to the electric furnaces, the slag is carefully skimmed off. A water collector is installed in the converter stack to catch the iron oxide thrown off during the blow. Some thought is being given to the use of the material reclaimed in this manner in some other department of the company. The bottom of the stack is built in hopper form, with a car below the hopper mouth for catching the converter projections.

The electric furnace equipment at Ford comprises 11 units, all arc furnaces, consisting of nine 12-ton electrics and two 4-ton jobs. However, as previously mentioned, all these units may not be used in the triplexing process. The electric furnaces used for triplexing are all acid-lined with transformers rated at 2,500 k.v.a.

In triplexing, the electric furnace acts primarily as a holding and mixing unit, and its power requirements are correspondingly lower than that of a similar sized unit used for melting. It is estimated that the 12-ton units at Ford would be rated about 4,000 k.v.a. if they were used for melting. The company is giving some consideration to the use of an open hearth, in place of an electric furnace, for the third step in triplexing, with the thought that such a procedure might show an economy over the electric unit, yet would make available the same quality of metal.

About 2 hrs. are required in the electric furnaces to make the required analysis adjustment and to build up the proper temperature of 1,675 deg. C. Emptying of a furnace for pouring takes about 2 hrs. at present, but as the men become more familiar with the procedure, it is expected that this time will be considerably shortened. The metal leaves the furnace at 1,675 deg. C. and is poured at 1,620 deg. C. This temperature is very critical for the type of work poured at the Ford plant, and is closely controlled.

While at present the electric furnaces are being used for batch operation, there is a continuous overlapping, the effect of which is to give a continuous

(*Continued at foot of next column.*)

(*Continued from previous column.*)

supply. It is planned eventually to operate with the electric furnaces used as holding furnaces, 5 tons being removed and a new batch of 5 tons being added so that the operation will be wholly continuous. This procedure contrasts with triplexing installations in other plants wherein the analysis is adjusted prior to going into the electrics, and the electric furnaces act as a mixing and holding vessel in order to provide a continuous supply of metal. In the latter installations, only one electric furnace is in operation at a time.

VALUE OF SEGREGATED SCRAP

It is worth noting, in connection with recent appeals for the segregation of alloy steel scrap, that already, at two Bethlehem Steel Company's plants, one-third to two-thirds of all alloying elements used are now being provided by the segregation and remelting of alloy scrap. But the cost and expenditure of manpower for segregation is higher in many instances than it should be for the reason that so much of this work has to be done as deliveries arrive at steel plants rather than prior to despatch. Mr. C. H. Herty, writing on the subject in "The Iron Age," draws attention to records kept of three comparable open-hearth practices making 1.85 nickel steel at a Bethlehem plant. No. 1, which included a scrap charge totalling 50 per cent. of the melt, made up half-and-half of returned mill scrap and non-alloy purchased scrap, yielded 37.7 tons of ingots of 1.85 nickel steel per 1,000 lbs. of added nickel. No. 2, in which a good grade of heavy melting scrap containing nickel steel scrap was substituted for non-alloy scrap, yielded 44.7 tons of ingots. But practice No. 3, which utilised properly segregated nickel scrap plus returned mill scrap and new molybdenum ingots per 1,000 lbs. of nickel, or almost double the production with returned scrap as the only other source of nickel. Seventeen and three-tenths more tons of ingots per 1,000 lbs. of nickel were secured than when miscellaneous alloy scrap was used as a secondary source of nickel, and the ingot yield was 24.3 tons greater than when only mill scrap was used as the supplementary source of nickel.

Economising Critical Metals in Foundries.—The necessity for reducing the amount of critical alloy metals used in the production of cast steel, cast iron, malleable iron, and highly alloyed castings was discussed at a recent meeting of the Ferrous Foundry Industry Advisory Committee with officials of the Steel Division of the W.P.B. It was pointed out to the committee that supplies of nickel, chromium, molybdenum, and vanadium are extremely limited, and that wherever possible, conservation or substitution measures should be taken to reduce their use for cast products. One of the possibilities discussed is the standardisation or simplification of formulæ used in metallurgical practices.

USING BLAST-FURNACE GAS FOR AUXILIARY HEATING

HOW MUCH CLEANING IS NEEDED?

The degree of fineness to which blast-furnace gas should be cleaned for various purposes was recently reviewed in a Paper on "Blast-Furnace Gas Conditioning," presented to the American Association of Iron and Steel Engineers by Mr. Owen R. Rice, who pointed out that there was some divergence of opinion as to how clean the gas should be for use in stove checkers of various kinds, for old or modern boilers, for soaking pits, and for coke ovens. The convenient answer to this question is to fine-clean all the gas, and have done with it, regardless of the variety of its uses. Fine-cleaning specifications usually involve 0.010 or less grain of dust per cub. ft., water vapour content corresponding to 100 per cent. saturation at about 80 deg. F. (11 grn. per cub. ft.), and not over 1 or 2 grn. of liquid entrained water. But the curve of installation and operation costs rises sharply upon breaking into the domain of fine cleaning, and there is precedent to show that a more conservative treatment of a considerable bulk of the gas is entirely reasonable, and renders it suitable and satisfactory for a substantial number of consumers.

Gas for Boilers

Boilers are usually not at their best with so-called raw or dust-catcher gas. The sensible heat may be an advantage if the gas can be brought to the boilers before most of the temperature is lost by radiation. But a vast accumulation of clinker in the combustion chamber, the dust on tubes and in breeching, and a long, dusty flame are not regarded as in line with modern boiler practice. However, an interesting demonstration has recently disclosed that in certain circumstances, so-called dust-catcher gas can be used in boilers with substantial satisfaction. A new steam-generating station having water-walls and continuous ash disposal, is said to be burning blast-furnace gas directly as it comes from a secondary dust catcher, with apparent satisfaction and success. The dust in the gas is viewed in the same light and treated in precisely the same manner as the ash in powdered coal. There is, so it is claimed at this plant, less fly ash from the stack when firing with blast-furnace gas than with powdered coal. This may indicate that the blast-furnace operation which serves this boiler is of the comparatively fume-free variety. If such is the case, it may be one of the circumstances contributing to the success of this interesting demonstration of the use of dust-catcher gas in a modern boiler. Perhaps the worst gas for boilers is primary gas of ten to twenty years ago—0.25 grn. primary gas, cold, moisture-saturated and sloppy, with anywhere from 5 to 50 grn. of entrained liquid water. In a few cases, boilers have been served the luxurious and costly diet of fine-cleaned gas. But within recent years, a number of large, modern steam generator plants have utilised with entire satisfaction an improved quality of primary gas. By this is meant under 0.15 grn. of dust per cub. ft., saturated at about 80 deg. F.. substantially free of entrained water.

Particularly beneficial in this improved primary gas is the elimination of entrained water. In one instance the output of a 10,000 boiler h.p. plant was increased by more than 6 per cent., firing the same quality of gas, after changing over from conventional primary-washed gas to what has been designated above as improved primary gas. The removal of entrained water is particularly impressive in this instance.

Summing up the topic of the proper degree of conditioning gas for boilers, it may be said that primary gas, once the bane of the boiler house, has now been improved to the extent of being an efficient and satisfactory boiler fuel. A dust content of 0.10 grn. per cub. ft. maximum, in conjunction with the elimination of entrained water, is an adequate specification for boiler gas.

Gas for Hot-Blast Stoves

There is considerable divergence in practice, and still more divergence of opinion, as to how clean gas should be for stoves having checkers of such-and-such a size or design. Most operators who have installed small or filler-type checkers have gone to fine-cleaned gas, nominally 0.01 grn. of dust per cub. ft. There are some instances, possibly more than a few, wherein stove remodelling projects have been held in abeyance because of the apparent magnitude of the co-ordinated gas-cleaning programme. There is a feeling in some quarters that entrained water in the gas contributes greatly to the fouling of stove checkers with dust; that if entrained water is eliminated, a dust content of, say, 0.07 grn. per cub. ft. is satisfactory for checkers having as small as 2¼-in. openings; and that for such checkers—although they may come under the classification of "small checkers"—it is not necessary to assume the high cost of fine gas cleaning.

Some years ago there appeared, to the astonishment of almost everyone concerned, a circumstance which may have had a demoralising influence upon the attempt to peg the requisite degree of cleanliness for stove gas. It was about 1929 that fine-cleaned gas was first applied to blast-furnace stoves. Since that time, there has come to light one instance after another, in steady procession, recording damage to upper checkers in varying degrees of seriousness, at stoves fired with fine-cleaned gas. By 1938 this situation was so widespread that a recognised authority in the United States blast-furnace refractory field stated that practically all hot-blast stoves operating up to that time under modern procedure of gas cleaning, showed evidence of fusion, slagging and shrinkage of top checkers and bonded brickwork. It seems to be established virtually beyond question that this fusion, slagging and shrinkage of brickwork is caused by free, unsatisfied alkalis penetrating the brick structure and causing mineralogical changes at certain critical temperatures.

Blast-Furnace Gas for Heating

The cleaner the gas, the worse this condition appeared to be, and it was not long before it was realised that the cleaner the gas the higher was the percentage of free alkalis in the dust that did remain in the gas. It did not seem to matter greatly whether the gas was cleaned to 0.05 or 0.005 grn. dust per cub. ft. The latter made up in intensity of destructive properties what it may have lacked in bulk. The identical phenomenon has almost never occurred in connection with stoves fired with any but fine-cleaned gas, because only in the latter case is there present in the dust free alkali which cannot be satisfied by acid minerals also in the dust. This matter of requisite stove gas cleanliness is not settled even now. But that is no reason to leave suspended in air the rather shocking account of the hot blast stoves fired with fine-cleaned gas. Actually almost all stoves built in the last three years and dedicated to the use of fine-cleaned gas, specify super-duty brick for the portions most vulnerable to alkali penetration. Coupled to the employment of super-duty brick has been the adoption of controlled limitation of flame temperatures playing on the top checkers and dome structure. This latter measure has been made possible through recent improvements both in gas burners and in pyrometer technique.

Stoves equipped with super-duty brick and operated with regulated dome temperatures have been running long enough to give strong indication that the detrimental effects of alkali fume in fine-cleaned gas have been at least greatly curbed.

General

Soaking pits fired with blast-furnace gas have received a variety of diet. In some instances it is fine-cleaned gas (0.01 grn.). But in one exemplary instance, the pits are fired with ordinary primary-washed gas, which passes through a considerable length of main and arrives in a condition comparable to what has been designated previously as "improved primary gas"—under 0.10 grn. dust, and dry. More than four years of operation on this basis seems to indicate that "improved primary gas" can be used satisfactorily at soaking pits.

Ever since blast-furnace gas was first applied to coke ovens, the hypothesis has been set up that no cleaning could be too fine. There was not so long ago a demonstration covering a five or six months period in which a battery of ovens was continuously fired with gas containing about 0.05 grn. dust. This did not prove to be satisfactory and was abandoned. The author is inclined to leave unmolested the specification that fine-cleaned gas, 0.01 grn. per cub. ft. or better, should be used at coke ovens.

The desirability of highly cleaned gas for gas engines is probably incontestable. For years they were served with so-called fine-cleaned gas of a former day—the 0.03 grn. gas from drum-type scrubbers or wet fans, and fouling of valves and scoring of cylinder liners were well known sources of trouble. More recently, intensive fine gas cleaning of the "double-O" variety has been most helpful in reducing gas engine maintenance.

Summary

Summing up this matter of gas cleanliness with relation to gas utilisation, it seems to be quite definitely established that for coke ovens and gas engines, the dust content should be reduced to 0.01 grn. or less. For modern, small-checker stoves, the general practice is to clean the gas to about 0.015 grn., although divergent opinions maintain, on the one hand, that this is unnecessarily clean, and, on the other, that it is not clean enough. Primary gas cleaned to 0.10 grn. or less and free from entrained water, appears to be satisfactory for boilers and soaking pits and similar steelwork uses.

PORTABLE FURNACE AND LADLE IN CASTING ALUMINIUM

More than 2,500 castings for an important piece of Army equipment have been made with a 1,000-lb. capacity portable melting furnace and ladle combination at General Electric's Schenectady Works with a negligible percentage of rejects. The portable furnace obviates the need for superheating its charge to the point where oxidation would be excessive, and by permitting a direct pour from furnace to mould, does away with the problems of preheating transfer ladles and crucibles. The furnace is fired by a removable burner easily attached to the side-wall by sliding it into a semi-circular flange and locking it down with a wing nut. The burner fixture fits against the furnace wall at a tangent so that the flame is spiralled downward into the charge. Oil is fed through a flexible metal hose and air through a rubber hose.

As the casting for which the furnace is used is about ½ in. thick, the best pouring temperature is from 700 to 710 deg. C. Ordinarily it would be necessary to heat the aluminium charge to as much as 800 deg. C., but with the portable furnace-ladle combination it is only necessary to go up to 750 deg. C. The furnace is lined with fire brick, and needed only two relinings in handling more than 2,500 charges. A graphite crucible would have had to be replaced much more often.

About one-third of the more than 2,500 castings made with the portable furnace were of an aluminium alloy of about 5 per cent. silicon, balance aluminium, and there were no rejects. What little difficulty was encountered was not the fault of the furnace, but was due to inexperience in handling another metal when a shift was made to an aluminium-copper silicon alloy (4 per cent. copper, 2½ per cent. silicon, balance aluminium). No "cold shots" were experienced on any of the castings, indicating proper temperature.

The portable furnace and ladle combination, loaded with its charge, weighs about three tons.

DON'T WASTE WASTE PAPER

BIRTHDAY HONOURS

SERVICES TO INDUSTRY

The King's Birthday Honours List contained many names associated with the iron and steel and allied industries. We give below brief biographical details of the recipients, together with the awards.

Privy Councillor

MR. HARCOURT JOHNSTONE, M.P., Parliamentary Secretary, Department of Overseas Trade.

Knights Bachelor

MR. HUGH EYRE CAMPBELL BEAVER, Director-General, Ministry of Works. He is a director of Sir Alexander Gibb & Partners, consulting engineers. He was Controller of Building Materials and Building Priority Officer, Ministry of Works and Buildings, 1940.

CAPTAIN JOHN PAUL BLACK, managing director of the Standard Motor Company, Limited, and chairman of the Joint Aero-Engine Committee.

MR. JOHN CRAIG, chairman and managing director of Colvilles, Limited. He is chairman also of Archibald Russell, Limited, Clyde Alloy Steel Company, Limited, Colville Constructional Company, Limited, Fullwood Foundry Company, Limited, James Nimmo & Company, Limited, Lanarkshire Steel Company, Limited, Motherwell Machinery & Scrap Company, Limited, Nimmo & Dunlop, Limited, Polmaise Patent Fuel Company, Limited, and Smith & McLean, Limited, and is on the board of the Bank of Scotland, British Iron & Steel Corporation, Limited, Harland & Wolff, Limited, James Dunlop & Company, Limited, Steel Company of Scotland, Limited, and other companies. Mr. Craig is a member of the council of the Federation of British Industries, a past-president of the National Federation of Iron and Steel Manufacturers and immediate past-president of the Iron and Steel Institute. He commenced his business career with Colvilles.

MR. GRAHAM CUNNINGHAM, Controller-General of Munitions Production, Ministry of Supply. He is chairman and managing director of Triplex Safety Glass Company, Limited, and is on the board of a number of other glass companies.

MR. JOHN MACFARLANE KENNEDY, deputy-chairman of the Electricity Commission. He was a partner in Kennedy & Donkin, consulting engineers, and has been engaged in electricity supply, distribution and traction works at home and abroad.

MR. ARCHIBALD MCKINSTRY, deputy-chairman and managing director of Babcock & Wilcox, Limited, and a member of the board of the Metal Box Company, Limited. After graduating he joined the British Westinghouse Company as junior engineer in 1902. He was connected with that company and the Metropolitan-Vickers companies in various capacities, including that of chairman, Metropolitan-Vickers Electrical Export Company, Limited, and director, Metropolitan-Vickers Electrical Company, Limited, until the end of 1930, when he resigned his connection with these interests.

DR. GEORGE PAGET THOMSON, F.R.S., professor of physics, Imperial College of Science and Technology.

Companion of Honour

MR. ERNEST WALTER HIVES, for services in the design of aero-engines. He is a director of Rolls-Royce, Limited.

Order of St. Michael and St. George, C.M.G.

MR. G. S. WHITHAM, Director-General, Production Services, Ministry of Supply, lately head of the British Technical Mission in Turkey.

Order of the British Empire

K.B.E.

SIR FRANKLIN SIBLY, as chairman of the Committee of Vice-Chancellors, is the mouthpiece of all the British Universities in negotiations with the Government. A geologist and administrator and member of the Advisory Council of the Committee of the Privy Council for Scientific and Industrial Research, he has rendered great scientific service to the State.

C.B.E.

BRIG.-GEN. A. C. BAYLEY, chairman of the Engineering and Allied Employers' Association, Birmingham, Wolverhampton, and Stafford districts.

MR. R. CHADWICK, chief designer and director, A. V. Roe & Company, Limited.

MR. H. L. GUY, chairman of the Gun Design Committee of the Scientific Advisory Committee.

MR. JAMES SPENCER HOLLINGS, chairman of the Anti-Glare Advisory Committee of the British Iron and Steel Federation, for services to civil defence. He is vice-chairman and joint managing director of Guest Keen Baldwins Iron & Steel Company, Limited, joint managing director of Orconera Iron Ore Company, Limited, and a director of other companies.

MR. HENRY MAIN, managing director of Caledon Shipbuilding & Engineering Company, Limited, and Regional Director (Merchant Shipbuilding and Repairs), East Scotland. He is a director of Sir W. G. Armstrong-Whitworth & Company (Shipbuilders), Limited.

MR. ARTHUR JOSEPH PALMER, a director of Vickers-Armstrongs, Limited.

CAPTAIN BERNARD HARTLEY PETER, Board of Trade representative, S.W. Regional Board, and chairman of the Railway Brakes and Signalling Export Group. He is managing director of Westinghouse Brake & Signal Company, Limited.

MR. R. K. PIERSON, chief designer, Vickers-Armstrongs, Limited (Aircraft).

MR. B. N. WALLIS, assistant chief designer, Vickers-Armstrongs, Limited.

India Office List

ORDER OF THE BRITISH EMPIRE

C.B.E.

MR. J. R. WALTON, Deputy Iron and Steel Import Controller, India.

M.B.E.

MR. R. C. ARBERY, Inspector of Metallurgy, India.

NEWS IN BRIEF

JARROW TOWN COUNCIL has set up an industries committee with a view to attracting new industries to the town.

THE ENGLISH SCIENTIFIC FILM ASSOCIATION has been formed. The acting secretary is Mr. M. Michaelis, 51, Fitzjohn's Avenue, London, N.W.3.

THE SORTING OF aircraft rivets is now being done almost eight times as quickly by a new machine developed by the Short complex of aircraft companies.

BY REMOVING 2,353 "Don't Trespass" plates from its property and substituting a small pasteboard notice, the L.M.S. Railway Company has recovered 59 tons of metal.

OVER 500,000 TONS of iron and steel railings has been collected since September, 1941. The quantity which remains to be collected is estimated to be comparatively small.

WE ARE INFORMED that Fairleede Engineering, Limited, Occupation Road, Walworth, London, S.E.17, have recently purchased the Chatteris Engineering Works, Chatteris, Cambs.

THE STEEL CORPORATION OF BENGAL, LIMITED, is paying a further interim dividend of 10 annas (6¼ per cent.) per share, free of Indian income-tax, making 16 annas per share, the same as in the previous year.

MR. D. A. CLARKE, 13, Basinghall Street, London, E.C.2, has been appointed liquidator (with a committee of inspection) of the Lawson Engineering Company, Limited, 25-26, Hanover Square, London, W.1.

THE MANCHESTER BRANCH of the Brush Electrical Engineering Company, Limited, Petters, Limited, and Brush Coachwork, Limited, has been removed from Daimler House, Wilmslow Road, Rusholme, to Yorkshire House, 45, Cross Street, Manchester, 2.

SIR HAROLD MORRIS, K.C., who recently sat as arbitrator in the claim by South Wales Siemens steel workers for the extension of payment of six shifts for five worked to others than those now enjoying the concession, has decided against the employees' claim.

BIRMINGHAM METALLURGICAL SOCIETY have appointed the following officers for the ensuing year: Mr. L. W. Law, president; Mr. W. L. Govier, Mr. N. F. Fletcher, Mr. L. C. Batchelor and Dr. T. Wright, vice-presidents; Mr. A. C. Craig, treasurer; and Mr. F. G. Tustin, secretary.

WM. NEILL & SON (St. Helens), Limited, industrial plant engineers, propose to increase their capital by the creation of a further 400,000 2s. ordinary shares and to issue 200,000 shares at 4s. 6d. per share to existing holders in the proportion of one new for every three held.

SIR STAFFORD CRIPPS told the Parliamentary and Scientific Committee at the House of Commons last week that Government departments such as his own Ministry of Aircraft Production still found it difficult to get all the skilled staffs they required. This was partly due to the poor output of qualified people from the universities and technical colleges.

PERSONAL

MR. R. F. HARRINGTON, foundry superintendent, Hunt-Spiller Manufacturing Company, Boston, U.S.A., has been awarded the John A. Penton Gold Medal "for outstanding pioneering work in foundry sand control."

MR. CARL F. JOSEPH, research metallurgist, General Motors Corporation, Sazinaw, has been awarded the William H. McFadden Gold Medal of the American Foundrymen's Association "for contributions to the metallurgy of malleable-iron production."

MR. JOHN DELOOZE has resigned his position as secretary of Rolls-Royce, Limited, as from June 1. Mr. DeLooze has been secretary of the company since its inception in 1907, and for some years prior to that was secretary of Royce, Limited, of Manchester—altogether a total service of 50 years.

SIR GEORGE KENNING, managing director of Kennings, Limited, motor and agricultural engineers, Clay Cross, Derbyshire, has been presented by the executive clerks of Kennings, Limited, with his portrait in oils "as a token of esteem and to mark the knighthood conferred upon him for services to Derbyshire."

CONCENTRATION OF IRON-FOUNDRIES

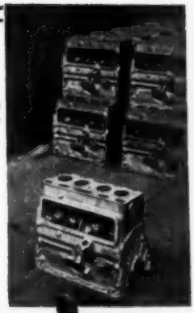
A voluntary scheme of concentration has been approved by the Board of Trade and other Government departments involving Mitchell, Russell & Company, Limited, Chattan Foundry, Bonnybridge, Stirlingshire, as the "nucleus" firm, and James Dobbie & Company, Banknock Foundry, Banknock, Stirlingshire, as the "closed" firm. The scheme will conserve manpower, fuel and electric power, and transport, and came into effect last Monday. Although their foundry is closed under this voluntary concentration scheme, James Dobbie & Company will continue as a trading firm. Their castings will be made by Mitchell, Russell & Company, Limited, orders for which will continue to be dealt with by Messrs. Dobbie at their Banknock office.

WYCLIFFE FOUNDRY & ENGINEERING COMPANY

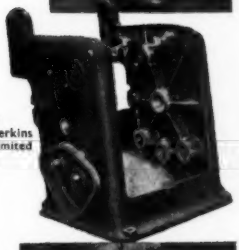
Due to the growing volume of engineering work, both general and specialised, now being carried on by the Wycliffe Foundry Company, Limited, Lutterworth, Rugby, in addition to normal activities as blackheart malleable founders, the name of the company has been changed to Wycliffe Foundry & Engineering Company, Limited. The company was incorporated in 1906 under the old title, and the addition of the words "and Engineering" was made by special resolution passed on May 10. The constitution of the company remains as before. The directors are: Messrs. G. C. B. Taite, J.P., Guy Barrett, S. F. Aspell, and H. M. Jones. The secretary and general manager is Mr. H. A. Bonney.

STANTON DALE

Refined PIG IRON for High Duty

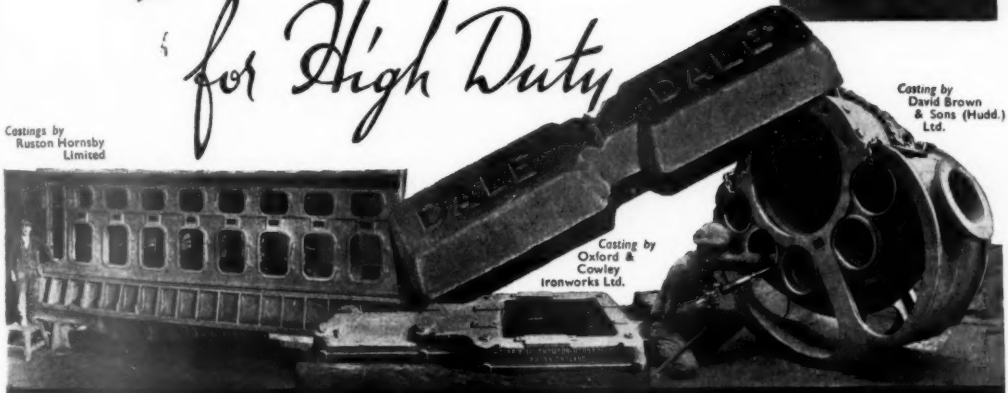


Castings by Morris Motors Limited.



Casting by Baker Perkins Limited

Castings by Ruston Hornsby Limited



Castings by Ruston Hornsby Limited

Casting by David Brown & Sons (Hudd.) Ltd.

Casting by Oxford & Cowley Ironworks Ltd.

THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM.

COMPANY NEWS

(Figures for previous year in brackets.)

Sanbra—Interim ordinary dividend of 5% (same).

Siemens Bros.—Dividend of 7½%, less tax, for 1942 (same).

Crompton Parkinson—Interim ordinary dividend of 7½% (same).

Ambrose Shardlow—Final ordinary dividend of 5%, making 7½% (same).

Park Gate Iron & Steel—Dividend of 4% on the ordinary shares (same).

Elmore's Metal—Loss for 1942, £322 (£364); credit forward, £13,119 (£13,441).

Fullers' Earth Union—Final ordinary dividend of 11%, less tax, making 15%.

Johnson Matthey—Final dividend of 3% (7%), plus bonus of 4% (nil), making 10% (same).

Geo. W. King—Net profit for 1942, after taxation, £18,137 (£15,779); ordinary dividend of 12½% (same).

S.G.B. (Dudley)—One year's arrears on the 5% cumulative preference shares for the year to June 30, 1942.

Aberdare Cables—Profit to October 31, £23,219; taxation, £16,250; dividend of 5%, £6,250; forward, £10,293 (£9,574).

G. Hopkins & Sons—Net profit, before taxation, for 1942, £19,484 (£13,788); dividend on the ordinary shares of 10% (nil).

Follsain Metals—Net profit for 1942, £5,013 (£3,765); subject to E.P.T.; balance of loss carried forward, £14,068 (£19,082).

James Dunlop—Dividend due July 1 on the 6½% preference shares is postponed. Payments are in arrear as from December 31, 1931.

Associated British Engineering—Net revenue to March 31 last, £18,114 (£20,118); ordinary dividend of 6% (5%); forward, £5,143 (£5,529).

F. H. Lloyd—Net profit for year to March 31 last, £47,266 (£14,816); final dividend on the ordinary shares of 7% (5%), making 10% (8%).

Drakes—Net profit for 1942, £8,271; dividend on the 6% cumulative preference shares, £2,400; dividend of 7½% on the ordinary shares, £1,875; forward, £15,754 (£13,757).

Newall Engineering—Trading profit to March 31, £83,002 (£85,397); "A" ordinary dividend of 12% (same); "B" ordinary dividend of 23.7% (same); forward, £15,438 (£15,105).

A.C.E. Machinery—Profit for year to September 30, 1942, £13,976 (£26,670); income-tax, £7,571 (£17,045); N.D.C., £813 (£1,238); final dividend of 7½%, making 15% (20%); forward, £7,649 (£6,557).

Ransomes & Rapier—Net profit for 1942, £26,008 (£19,938); war damage contribution, £2,292 (£3,645); to general reserve, £5,000 (same); final ordinary dividend of 4%, making 6% (5%), free of tax; forward, £3,483 (£1,117).

Pease & Partners—Profit for the year to March 31, 1943, £395,964 (£402,589); debenture interest, £16,000; depreciation, £70,000 (same); reserve for renewals and contingencies, £40,000 (same); tax provision, £65,000 (£70,000); ordinary dividend of 8% (same); forward, £307,565 (£304,692).

Chubb & Son's Lock & Safe—Profit to March 31, £15,660 (£42,257); taxation credit, £6,000; available after debenture interest and other charges, £16,883 (same); 8% preference dividend, £1,732 net; 10% preferred ordinary dividend, £2,335 net; forward, after ordinary payment, £9,316 (same).

Union Steel Corporation (of South Africa)—Net profit for 1942, £147,015 (£141,056); dividends on "A" and "B" preference shares, £20,000 (same); dividends of 3% and 5% on the ordinary shares, £48,000 (same); to depreciation of stock, £50,000 (nil); to general reserve, £25,000 (£75,000); forward, £23,726 (£19,711).

OBITUARY

MR. THOMAS MACGILL COCHRANE, chairman and joint managing director of Cochrane & Sons, Limited, shipbuilders, of Selby, and a director of several other companies, has died.

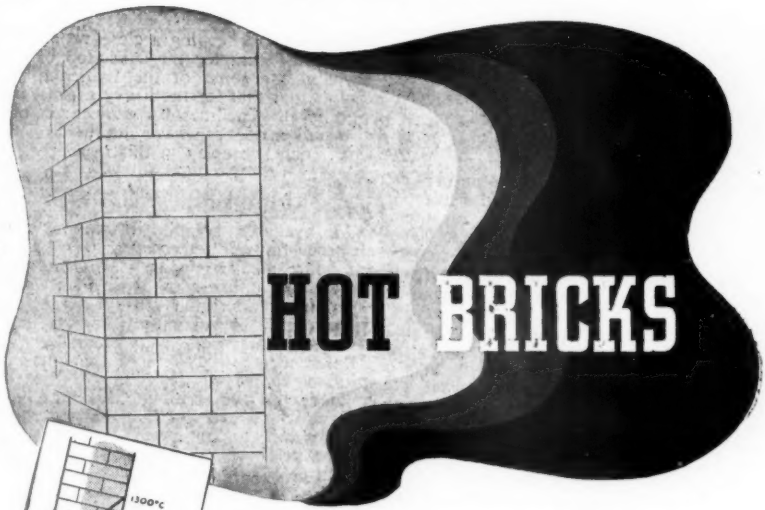
NEWS HAS JUST been received of the death in March of Mr. Frank J. Lanahan, a prominent Pittsburgh foundry owner. He was president of the American Foundrymen's Association in 1933.

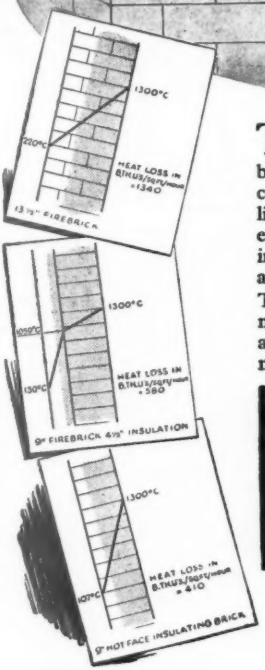
MR. RAYMOND WHARTON, of Brimington, Derbyshire, who was with the Staveley Coal & Iron Company, Limited, for 50 years, has died, aged 82. For more than 35 years he held a responsible position in the company's foundries department.

MR. EDSEL B. FORD died on May 26 in Detroit, aged 49. Son of Mr. Henry Ford, founder of the Ford Motor Company, he became secretary of the concern at the age of 22. In 1929 he cut the first sod on the site at Dagenham, Essex, now occupied by the Ford factory.

MR. WILLIAM FREELAND, of Wishaw, steelworks manager with the Steel Corporation of Bengal, Limited, has died on board ship while travelling home on leave. He had been in India for the past five years. Mr. Freeland was with the Pather Iron and Steel Works for twelve years. He gained further experience of the steel industry in America, and before accepting the Indian appointment he was a mills manager with the Steel Company of Scotland.

COL. LIONEL BEAUMONT-THOMAS, J.P., who was for more than 25 years a director of Richard Thomas & Company, Limited, iron, steel and tinplate makers, etc., has been officially reported killed in action. He was 50 years of age. In the last war he served in the R.H.A. and R.A. in France and Italy, gaining the Military Cross and being mentioned in dispatches. Returning to civil life he became a leading figure in the Welsh steel and tinplate industries. He rejoined the Army on the outbreak of the present war, and early in December it was known that he was missing. Col. Thomas received his early training in the steel industry at the Arbed Works, Luxemburg. He was a grandson of the founder of Richard Thomas & Company. He was a Freeman of the City of London and sat in Parliament as a Conservative for the King's Norton Division of Birmingham from 1929 until 1935.





THE heat absorbed and stored in a hot face insulating brick lining is only about 33% of that stored in a firebrick lining. As the fuel used in heating up a furnace is comparatively in inverse ratio to the heat stored in the lining, it is obvious that the use of hot face insulation must effect considerable fuel economy when heating up. In intermittent furnaces especially, the economies effected assume outstanding proportions.

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G.P.168

Raw Material Markets

IRON AND STEEL

Foundrymen, although they are being supplied with all the iron necessary to satisfy their requirements, are not always getting the descriptions they would normally utilise. This applies more especially to the heavy foundries, which are engaged almost solely on the production of castings for various Government departments. These foundries usually take up the better-quality irons, such as medium- and low-phosphorus grades, hematite, etc., which are now in comparatively short supply. In their stead, however, heavy engineers are able to make some use of the plentiful supplies of high-phosphorus iron, together with steel scrap and other materials offering quite freely. This arrangement, while not ideal, is operating quite well.

The light foundries have always relied mainly on high-phosphorus iron, so that they are still able to obtain all the raw material they need. Rather busier conditions are reported at a number of these foundries, few of which, however, are operating to capacity. In the main, the plans for the concentration of this section has been held up, and it is hoped that more employment will shortly be found for light foundries.

Called upon by various Government departments to provide increased tonnages of light sections, thin plates, sheets, etc., the re-rollers are indenting for still larger supplies of steel semis. In some quarters there has been a tendency to view the position with undisguised apprehension, but at least it can be claimed that immediate requirements are covered, and since the Control is fully alive to the necessity of maintaining the mills in full operation, it may be assumed that either by increased power production or the further import of overseas material supplies will not be permitted to run short. One phase of the war effort—the creation of new factories and the extension of existing establishments—is now far past its peak, and there is consequently a very limited demand for the heavier sizes of joists and sections. Light and medium sizes of structural steel are still on the active list, while the demand for all descriptions of plates is such that virtually the whole of the output for the third period is already allocated.

The scrap iron and steel position shows little variation; deliveries seem to be adequate for current requirements, and fair stocks are on hand, but the authorities are keeping a close watch on the situation and are encouraging the collection of further supplies. Demand for some of the lighter qualities tends to decline, but that for the heavy sorts is maintained at a high level. Facilities for collection, preparation and distribution of scrap have improved, and there is now very much less delay in this respect.

NON-FERROUS METALS

All available supplies of copper continue to be absorbed for war purposes, and essential requirements are being met satisfactorily. Other classes of consumers are unlikely to receive more liberal allocations until after the war, as the authorities are endeavouring to cut imports to the bone in order to save shipping space.

Reference to the effect of the international tin restriction scheme on the economic life of the country is made in the Bulletin of the Banco Minero de Bolivia, which declares that without the International Tin Committee conditions on the international tin market prior to the war would have become really catastrophic, creating a state of extreme poverty in producing countries, especially Bolivia.

The formation of the Tin Sales Corporation, a company operating on a non-profit basis, is announced in the United States. It is believed that the Corporation will cope with in future the distribution of tin already bought, or which will be bought, by the Metals Reserve Company, in addition to tin from the Longhorn smelter.

Cable and battery makers are utilising large tonnages of lead, while the manufacture of solder and bullet rod is also accounting for quite an impressive quantity. Adequate supplies are being delivered to consumers engaged on war contracts, but imports of the metal are being kept down to the minimum commensurate with the needs of the war effort.

A MEETING of the London Local Section of the Institute of Metals will be held at the Junior Institution of Engineers (Incorporated), 39, Victoria Street, London, S.W.1, on Thursday, June 17, at 6.30 p.m., when Dr. S. W. Smith will deliver an address on "Some Technical Aspects of Metal Resources." Dr. Smith will review the characteristics of some of the natural resources of non-ferrous metals and their relation to the methods available for their successful extraction and recovery.

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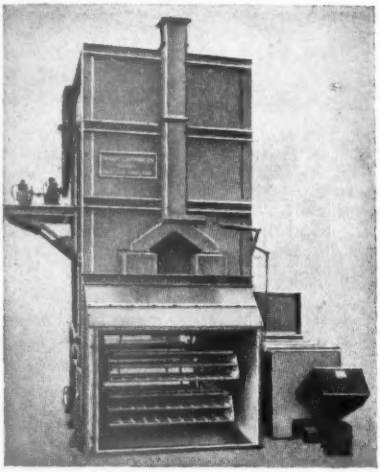

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CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, June 9, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.)

Ferro-silicon (5-ton lots): 25 per cent., £21 5s.; 45 per cent., £23 10s.; 75 per cent., £36 10s.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £44; max. 2 per cent. C, 1s. 0½d. lb.; max. 1 per cent. C, 1s. 1½d. lb.; max. 0.5 per cent. C, 1s. 1¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s. 6d.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ⅜ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20×14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 10s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25 ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11½d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10½d.; wire, 10½d.; rolled metal, 10½d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 13½d. per lb.; sheets to 10 w.g., 14½d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

NON-FERROUS SCRAP

Controlled Maximum Prices.—Bright untinned copper wire, in crucible form or in hanks, £57 10s.; No. 1 copper wire, £57; No. 2 copper wire, £55 10s.; copper firebox plates, cut up, £57 10s.; clean untinned copper, cut up, £56 10s.; braziery copper, £53 10s.; Q.F. process and shell-case brass, 70/30 quality, free from primers, £49; clean fired 303 S.A. cartridge cases, £47; 70/30 turnings, clean and baled, £43; brass swarf, clean, free from iron and commercially dry, £34 10s.; new brass rod ends, 60/40 quality, £38 10s.; hot stampings and fuse metal, 60/40 quality, £38 10s.; Admiralty gunmetal, 88-10-2, containing not more than ¼ per cent. lead or 3 per cent. zinc, or less than 9¼ per cent. tin, £74 10s., all per ton. ex works.

Returned Process Scrap.—(Issued by the N.F.M.C. as the basis of settlement for returned process scrap, week ended June 5, where buyer and seller have not mutually agreed a price; net, per ton, ex-sellers' works, suitably packed):—

BRASS.—S.A.A. webbing, £48 10s.; S.A.A. defective cups and cases, £47 10s.; S.A.A. cut-offs and trimmings, £42 10s.; S.A.A. turnings (loose), £37; S.A.A. turnings (baled), £42 10s.; S.A.A. turnings (masticated), £42; Q.F. webbing, £49; defective Q.F. cups and cases, £49; Q.F. cut-offs, £47 10s.; Q.F. turnings, £38; other 70/30 process and manufacturing scrap, £46 10s.; process and manufacturing scrap containing over 62 per cent. and up to 68 per cent. Cu, £43 10s.; ditto, over 58 per cent. to 62 per cent. Cu, £38 10s.; 85/15 gilding metal webbing, £52 10s.; 85/15 gilding defective cups and envelopes before filling, £50 10s.; cap metal webbing, £54 10s.; 90/10 gilding webbing, £53 10s.; 90/10 gilding defective cups and envelopes before filling, £51 10s.

CUPRO NICKEL.—80/20 cupro-nickel webbing, £75 10s.; 80/20 defective cups and envelopes before filling, £70 10s.

NICKEL SILVER.—Process and manufacturing scrap: 10 per cent. nickel, £50; 15 per cent. nickel, £56; 18 per cent. nickel, £60; 20 per cent. nickel, £63.

COPPER.—Sheet cuttings and webbing, untinned, £54; shell-band plate scrap, £56 10s.; copper turnings, £48.

IRON AND STEEL SCRAP

(*Delivered free to consumers' works. Plus* 3¼ *per cent. dealers' remuneration. 50 tons and upwards over three months, 2s. 6d. extra.*)

South Wales.—Short heavy steel, not ex. 24-in. lengths, 82s. to 84s. 6d.; heavy machinery cast iron, 87s.; ordinary heavy cast iron, 82s.; cast-iron railway chairs, 87s.; medium cast iron, 78s. 3d.; light cast iron, 73s. 6d.

Middlesbrough.—Short heavy steel, 79s. 9d. to 82s. 3d.; heavy machinery cast iron, 91s. 9d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 89s. 3d.; medium cast iron, 79s. 6d.; light cast iron, 74s. 6d.

Birmingham District.—Short heavy steel, 74s. 9d. to 77s. 3d.; heavy machinery cast iron, 92s. 3d.; ordinary heavy cast iron, 87s. 6d.; cast-iron railway chairs, 87s. 6d.; medium cast iron, 80s. 3d.; light cast iron, 75s. 3d.

Scotland.—Short heavy steel, 79s. 6d. to 82s.; heavy machinery cast iron, 94s. 3d.; ordinary heavy cast iron, 89s. 3d.; cast-iron railway chairs, 94s. 3d.; medium cast iron, 77s. 3d.; light cast iron, 72s. 3d.

(NOTE.—*For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less.*

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Small Advertisements in this section of the Journal are accepted at the *prepaid* rate of 2d. per word in ordinary type and 3d. per word in capitals.
Minimum charge for one insertion 4/-.

SITUATIONS

FOUNDRY MANAGER (37), M.I.B.F., desires change, with post-war prospects; handling approx. 300 male and female; competent; metals, general engineering, all types pump and compressor castings; sound knowledge moulding machines and modern production methods.—Box 878, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

PRACTICAL Iron Foundry Foreman desires change; over 20 years' experience as Head Foreman; highest references.—Box 882, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOUNDRY MANAGER required to take charge of Foundry producing high class small Whiteheart specialised Castings; must be experienced in all stages of production up to the machine shop; permanent position, with excellent prospects; West Midland district; please state age, experience, and salary required.—Box 886, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

HEAD FOREMAN required to take charge of Tropenas Plant and Electric Furnace producing 300 tons of Steel per week. Practical man required, fully conversant with Cupola and Convertor Plant. Must be able to handle men and be strong disciplinarian. Good wage assured to suitable applicant. State full particulars.—Box 880, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

PATENT

THE Proprietors of Letters Patent No. 484,270, relating to Production of metals and alloys having a low content of carbon and silicon, desire to grant licences under the patent to interested parties, on reasonable terms, for the purpose of exploiting the same and ensuring its full commercial development and practical working in this country.—Inquiries to be addressed to CRUIKSHANK & FAIRWEATHER, 29, Southampton Buildings, Chancery Lane, London, W.C.2.

BUSINESS FOR SALE

WELL equipped Iron and Brass Foundry in Midlands, including Freehold Premises.—Box 874 FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MACHINERY

WANTED.—One Compressed Air Jolt Squeeze Straight Draw MOULDING MACHINE and One Jolt Squeeze Rollover Moulding Machine. Both machines to take boxes approximately 20 in. by 18 in. Must be modern type and in good condition.—Apply, stating price and where machines can be seen, to Box 842, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MACHINERY—*contd.*

WANTED.—Coke- or Gas-Fired Tilting or Rotary Metal Smelting Furnace; up to 1 ton brass capacity.—Offers Box 876, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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Jackman Osborn Type 601 rollover Jolt Ram, table 30 in. long.
Samuelson Hand Ram, turnover table 24 in. by 19 in.
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FOR SALE.—One 10 h.p. Squirrel Cage Motor, by Brook; 960 revs., 400 volts, 3-phase, 50 periods; complete with two Slides and one Star Delta starter; in good running order; price £20, plus carriage.—Box 888, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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MISCELLANEOUS

WANTED.—Old Broken Crucibles; free from slag, etc.—State lowest price, f.o. truck and quantity available monthly, to Box 884, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

MISCELLANEOUS—*contd.*

REQUIRED.—150 Cast-Iron Floor Plates; dimensions 3 ft. square by 1 in. to 1½ in. thick.—Box 862, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

LEADING GREY IRON FOUNDRY has capacity for repetition castings; reasonable (not cut) prices, and excellent delivery.—Box 890, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

FOR SALE.—FOUNDRY CORE-DRYING PLATES; 3/16 in. thick, width 10½ in. (a limited quantity of 9½ in. wide); any length up to 48 in.; price, 12s. 6d. per cwt., f.o.b.—Box 754, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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